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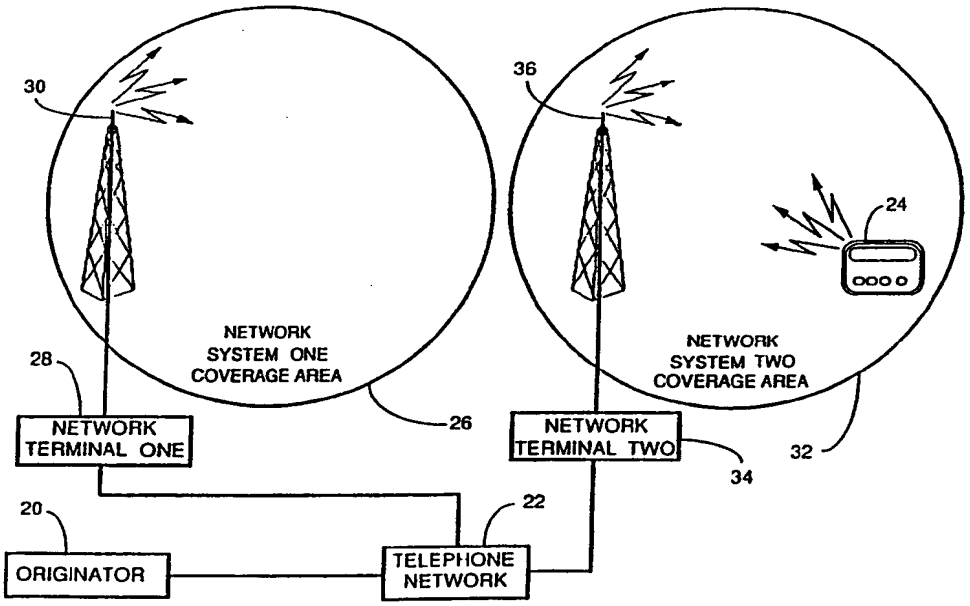

(57) Abstract

When a first paging network system terminal (28), determines that a pager (24) is not within the coverage area (26) of that network system, a paging message is automatically transmitted from another paging network system terminal (34). The pager wearer can advise the first paging network system terminal (28) of his travel to another paging network system coverage area (32) or the first paging network system terminal (28) forwards the paging message to a predesignated alternate paging network system terminal (34).

* See back of page

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METHOD AND APPARATUS FOR AUTOMATICALLY TRANSMITTING A PAGING MESSAGE IN AN ALTERNATE PAGING SYSTEM

Field of the Invention

This invention relates in general to selective call receiver network systems, and more particularly to a selective call receiver network system capable of automatically switching transmission of a message to a second selective call receiver network system upon determining that the selective call receiver is not within the coverage area of the first network system.

Background of the Invention

Selective call receivers, including pagers, are widely used to disseminate business and other information. Alphanumeric, voice or tone-only messages can be delivered by radio transmission from a network system. Some network systems have a localized coverage area, some even solely within one building such as a hospital. These network systems are called on-site paging network systems. Other network systems, called wide area network systems, allow for transmission of messages over a large area. In this manner, a selective call receiver can receive messages anywhere within an urban area, or even statewide. Nationwide and international paging schemes are being developed to allow for messages to be forwarded from an originating network system to a network system wherein the transmission can be received by the pager wearer.

In on-site paging systems such as those used in hospitals, it is necessary for the pager wearer to manually inform the network system when he is no longer within the coverage area. Once informed, the system can route incoming pages to the surrounding wide area system, or to whatever alternate system is designated. If the

pager wearer is a doctor and receives an emergency call to proceed to a location outside the hospital within the coverage area of the wide area system, he must take the time to call up the paging network system and advise it of his departure from the coverage area. The system would then route his pages to the wide area network system for transmission. If the doctor is detained within the hospital after the network system begins transmitting his pages on the wide area system, he may not receive those pages. Also, if the doctor is in such a hurry as to forget or not be able to take the time to call the on-site network system, the doctor will not receive any of his pages during his time outside the on-site system's coverage area.

Nationwide paging schemes, such as that discussed in U.S. Patent 4,178,476, allow for a message to be passed from one network system to another after the pager wearer has informed the network system of his intent to depart the coverage area and, upon his arrival at his destination, after the pager wearer has again called the network system to inform it of his arrival at his destination. The drawback of this scheme is that it requires two actions on the part of the pager wearer to avoid lost messages.

Thus, what is needed is a scheme for automatically transferring transmission from one paging network system to another upon the first network system determining that the pager wearer is no longer within its coverage area.

Summary of the Invention

Accordingly, it is an object of the present invention to provide an improved selective call receiver network system.

It is another object of the present invention to provide a method and apparatus for automatically switching

transmission of a paging message from one network system to another upon determining that the pager wearer is no longer in the first network system.

It is a further object of the present invention to provide a method and apparatus for storing a message received in a first network system for later transmission in a second network system after the pager wearer advises the first network system of his arrival in the coverage area of the second network system.

In carrying out the above and other objects of the invention in one form, there is provided a method and apparatus for transmitting a message from a second network system if the selective call receiver does not acknowledge reception from a first network system.

The above and other objects, features, and advantages of the present invention will be better understood from the following detailed description taken in conjunction with the accompanying drawings.

Brief Description of the Drawing

FIG. 1 is a block diagram of the selective call receiver according to the present invention.

FIG. 2 is a diagram of the present invention.

FIG. 3 is a flow chart of the operation of the preferred embodiment of the paging terminal according to the present invention.

FIG. 4 is a flow chart of the operation of an alternate embodiment of a paging terminal according to the present invention.

Detailed Description of the Invention

Turning now to the various drawing figures, in which like numerals reference like parts, a detailed description of the preferred embodiment will be provided. Referring

to FIG. 1, a block diagram of a selective call receiver according to the present invention comprises pager circuitry 2 coupled to each of antenna 4, battery 6, alert apparatus 8, and control apparatus 10. Control apparatus 10 could be any or all of controls such as on/off, volume control, and display control switches for performing the pager operations well known to those skilled in the art. A display apparatus 12 may be included in the pager for visually displaying an alert or a message. For a more detailed description of the structure and operation of a selective call radio paging receiver of the type shown in FIG. 1, reference is made to U.S. Patent Number 4,518,961, issued May 21, 1985 and entitled "Universal Paging Device With Power Conservation"; U.S. Patent Number 4,649,538, issued March 10, 1987 and entitled "Radio Paging Device With Improved Test Modes"; and U.S. Patent Number 4,755,816, issued July 5, 1988 and entitled "Battery Saving Methods for Selective Radio Paging Receiver", all commonly assigned to the same assignee as the present invention, and the teachings of which are hereby incorporated by reference.

Additionally, acknowledge back (ACKBACK) transmitter 14 is coupled to pager circuitry 2 and antenna 4 for transmitting an acknowledgement signal in response to receipt of a paging message. In an alternate ACKBACK scheme particularly suitable to lengthy transmissions such as voice transmissions, an interrogation signal is transmitted from the network system to determine if the selective call receiver is within the network's coverage area. Transmitter 14 transmits an acknowledgement signal in response to receipt of the interrogation signal. The network system then transmits the paging message after receipt of an acknowledgement signal, thereby minimizing air time by not broadcasting lengthy messages to selective call receivers which cannot receive the messages.

Referring to FIG. 2 originator 20 of a paging message typically dials up the public switched telephone network 22 to send the paging message to a particular selective call receiver 24 believed to be within coverage area 26 of Paging Network System One, comprising paging network terminal 28 and transmitter 30. If Paging Network System One is an on-site paging network system, such as that used in a hospital, telephone network 22 could be a PBX localized intercom network. Originator 20 passes his message to terminal 28 and the message is transmitted via transmitter 30 throughout coverage area 26. If the message is alphanumeric data which could be transmitted in real time, terminal 28 transmits the message via transmitter 30 to determine if pager 24 is receiving within coverage area 26. If the message is voice data, terminal 28 transmits an interrogation signal via transmitter 30 in order to determine if selective call receiver 24 is receiving within coverage area 26.

Terminal 28 determines that selective call receiver is not receiving within coverage area 26 if it has not received an acknowledgement signal from pager 24 within a predetermined time after transmission. With no acknowledgement signal received, terminal 28 contacts Paging Network System Two, comprising paging network terminal 34 and transmitter 36, via telephone network 22. In a manner identical to that of Paging Network System One, terminal 34 determines whether pager 24 is within coverage area 32 of transmitter 36. Pager 24 is receiving within coverage area 32 and transmits an acknowledgement signal to terminal 34 that the message or the interrogation signal was received. If transmitter 36 had transmitted an interrogation signal, upon receipt of the acknowledgement signal, terminal 34 would transmit the paging message to pager 24 via transmitter 36. In an alternate embodiment, if Paging Network System Two is not equipped with acknowledge-back capability, terminal 34

would simply transmit the paging message via transmitter 36.

In order for a pager wearer to be able to receive messages in more than one network, he must either be equipped with a different pager for each of the network systems or wear a pager capable of scanning between the frequencies of the network systems.

In one embodiment of the present invention, Paging Network System One and Paging Network System Two are related networks such as an on-site paging system and the surrounding wide area paging network. In this particular embodiment, terminal 28 inherently knows to which alternate paging network to transfer. In a second embodiment of the present invention, particularly suitable to a nationwide or worldwide paging scheme, the wearer of pager 24 would inform Paging Network System One either before or after leaving coverage area 26 of which paging network system he would be able to receive. Notice could be given to the network system several days in advance of departure because, after receiving the information identifying Paging Network System Two, terminal 28 would attempt successful transmission of all paging messages from Paging Network System Two after determining that pager 24 is not within coverage area 26. If no acknowledgement signal is received by terminal 34, the paging messages are stored for later transmission. In the preferred embodiment, particularly suitable to a pager wearer who regularly travels between the coverage area of an on-site paging network system and the coverage area of a wide area paging network system, the stored paging messages would be rebroadcast periodically, for example every hour, until such time as their receipt has been acknowledged by the pager. In an application where the pager wearer travels from one wide area network system to a new wide area network system, the stored paging messages would be broadcast after the pager wearer has been located

within the coverage area of the new network system either by acknowledgement of receipt of a subsequent message or by the pager wearer informing the wide area network system that he has arrived in the coverage area of the new network system.

Referring to FIGS. 3A and 3B, a flowchart of the operation of terminal 28 (FIG. 2) in the preferred embodiment of the present invention is shown. In the preferred embodiment, the paging message consists of alphanumeric data which can be transmitted in a time period not substantially greater than the time period needed for transmission of an interrogation signal. When the system becomes operational, terminal 28 awaits receipt of a paging message from an originator 42. If no message has been received, the operation loops back to continue awaiting a paging message 42. Once a paging message has been received from an originator, the message is sent 44 and terminal 28 waits a predetermined period of time for receipt of an acknowledgement signal 46. In the preferred embodiment, the predetermined period of time would be less than one second.

If an acknowledgement signal is received 46, terminal 28 informs the originator that the message was sent and received 48 and returns to await another paging message 42. If no acknowledgement signal is received 46, terminal 28 informs the originator that the pager wearer is not within coverage area 26 (FIG. 2) of the network system 50. If the originator wishes to change the message before it is rebroadcast 51, the originator records a new message 52. If the pager wearer has advised the network system that he is changing paging networks 53, terminal 28 will access the paging terminal of the new network system 56. If the pager wearer has not advised the network system that he is changing paging networks 53, terminal 28 will access the paging terminal of an alternate network system 54. Terminal 28 in the preferred embodiment has the

identity of an alternate network stored for each pager normally receiving paging messages from terminal 28.

After terminal 28 has accessed the new or alternate network system, the paging message is transmitted 58 within coverage area 32 (FIG. 2) of the new or alternate network system by new or alternate terminal 34. If an acknowledgement signal is received within the predetermined period of time 60, terminal 28, having received data from terminal 34 indicating that an acknowledgement signal was received, informs the originator that the message was sent and received 48, and returns to await another paging message 42. If no acknowledgement signal is received within the predetermined period of time 60, terminal 28, having received data from terminal 34 indicating that no acknowledgement signal was received, informs the originator that the pager wearer is not within the new or alternate network system's coverage area 62.

Next, terminal 28 inquires whether the originator wants to have the paging message stored for sending at a later time 64. If the originator does not want the message stored, terminal 28 disconnects the originator 66 and returns to await another paging message 42. If the originator wants the message stored, terminal 28 inquires whether the originator wishes to change the message before storing it 68. If the originator wishes to change the message, he does so 70. Then, terminal 28 stores the message 72 to later transmit the paging message after passage of a predetermined period of time. Terminal 28 then disconnects the originator 66 and returns to await another paging message 42.

Terminal 28 would send the paging message after waiting a sufficiently long predetermined period of time. If no acknowledgement signal is received, terminal 28 would continue to send the paging message after passage of the predetermined period of time until an acknowledgement

signal is received. It would be obvious to one skilled in the art that stored messages could alternately be retrieved by the pager wearer contacting terminal 28.

As will also be obvious to one skilled in the art, steps 48, 50, and 62 are optional user friendly steps included in the preferred embodiment of the present invention. Most paging schemes include verification to the originator that the paging message has been sent. While the originator is on the phone line awaiting verification, the preferred embodiment decreases the dead time by advising the originator of the paging message transmission status. The preferred embodiment also and allows originator interaction to permit the originator to choose between several optional actions to take.

Referring to FIG. 4, a flow chart of an alternate embodiment of the operation of terminal 28 is shown. In this alternate embodiment, the paging message consists of data which may only be transmitted in a time period substantially greater than the time period needed for transmission of an interrogation signal, such as voice data. When the system becomes operational, terminal 28 determines if a paging message has been received from an originator 82. If no message has been received, the operation loops back to continue awaiting receipt of a paging message 82.

Once a paging message has been received from an originator, an interrogation signal is sent 84 to determine if the pager wearer is within coverage area 26 (FIG. 2) and terminal 28 waits a predetermined period of time for receipt of an acknowledgement signal 86. If an acknowledgement signal is received, terminal 28 transmits the message to the pager 88 and returns to await another paging message 82.

If no acknowledgement signal is received, terminal 28 accesses the designated alternate paging network system or a new network system identified previously by the pager

wearer 90, and the interrogation signal is transmitted 92 by terminal 34 (FIG. 2) to coverage area 32 of the new or alternate network system. If an acknowledgement signal is received within the predetermined period of time 94, terminal 28, having received data from terminal 34 indicating that an acknowledgement signal was received, forwards the message to terminal 34 which transmits the message 88 and terminal 28 returns to await another paging message 82. If no acknowledgement signal is received within the predetermined period of time 94, terminal 28 could either store the message to transmit again after waiting a predetermined interval of time and return to await a new message 82 or return to await a new message 82 without storing the message, whichever methodology is preprogrammed within terminal 28.

As will be obvious to one skilled in the art, the operation of the alternate embodiment could include any of the optional user friendly steps included in the preferred embodiment of the present invention.

By now it should be appreciated that there has been provided a method and apparatus for automatically transferring transmission from one paging network system to another upon the first network system determining that the pager wearer is no longer within the coverage area of the first network system.

CLAIMS

1. A method for sending a message to a selective call receiver comprising the step of transmitting a message from a second network system if the selective call receiver does not acknowledge reception from a first network system.

2. A method for sending a message to a selective call receiver comprising the steps of:

transmitting a first interrogation signal from a first network system;

transmitting said message from said first network system if an acknowledgement signal is received from said selective call receiver within a first predetermined period of time after transmission of said first interrogation signal;

transmitting a second interrogation signal from a second network system if an acknowledgement signal is not received from said selective call receiver within a first predetermined period of time after transmission of said first interrogation signal; and

transmitting said message from said second network system if said acknowledgement signal is received from said selective call receiver within a second predetermined period of time after transmission of said second interrogation signal.

3. The method of Claim 2 further comprising the step of storing said message for later transmission if said acknowledgement signal is not received from said selective call receiver within a second predetermined period of time after transmission of said second interrogation signal.

4. An apparatus for transmitting a message comprising:

a first network system;

a second network system;

a selective call receiver; and

means for switching transmission of said message from said first network system to said second network system if said selective call receiver does not acknowledge reception of said message from said first network system.

5. The apparatus of Claim 4 wherein said first network system is an on site paging system and said second network system is a wide area network system.

6. The apparatus of Claim 4 wherein said selective call receiver comprises a means for generating an acknowledgment signal for indicating reception of said message from said first network system or said second network system, and wherein said means for switching transmission is responsive to nonreceipt of said acknowledgment signal within a predetermined period of time after transmission of said message by said first network system.

7. An apparatus for transmitting a message comprising:

a selective call receiver;

a first network system for transmitting a first signal;

a first means for determining whether said selective call receiver receives said first signal transmitted from said first network system;

a second network system for transmitting a second signal;

a second means for determining whether said selective call receiver receives said second signal transmitted from said second network system; and

a third means responsive to said first and second means for transmitting of said message to said selective call receiver from said first or second network system, wherein said third means transmits said message from said first network system if said first means determines that said selective call receiver received said first signal and said third means transmits said message from said second network system if said first means determines that said selective call receiver did not receive said first signal and said second means determines that said selective call receiver received said second signal.

8. The apparatus of Claim 7 wherein said selective call receiver comprises a means for transmitting an acknowledgement signal in response to receiving an interrogation signal from said first or second network system.

9. The apparatus of Claim 8 wherein said first means comprises:

a fourth means for transmitting a first interrogation signal from said first network system; and

a fifth means for receiving said acknowledgement signal from said selective call receiver; wherein said first means determines that said selective call receiver is within said first network system if said fifth means receives said acknowledgement signal within a first predetermined period of time.

10. The apparatus of Claim 9 wherein said second means comprises:

a sixth means for transmitting a second interrogation signal from said second network system; and

a seventh means for receiving said acknowledgement signal from said selective call receiver; wherein said second means determines that said selective call receiver

is within said second network system if said seventh means receives said acknowledgement signal within a second predetermined period of time.

11. The apparatus of Claim 8 wherein said second means comprises:

an eighth means for transmitting a second interrogation signal from said second network system; and

a ninth means for receiving said acknowledgement signal from said selective call receiver; wherein said second means determines that said selective call receiver is within said second network system if said ninth means receives said acknowledgement signal within a predetermined period of time.

12. The apparatus of Claim 7 wherein said first network system is an on site paging system and said second network system is a wide area network system.

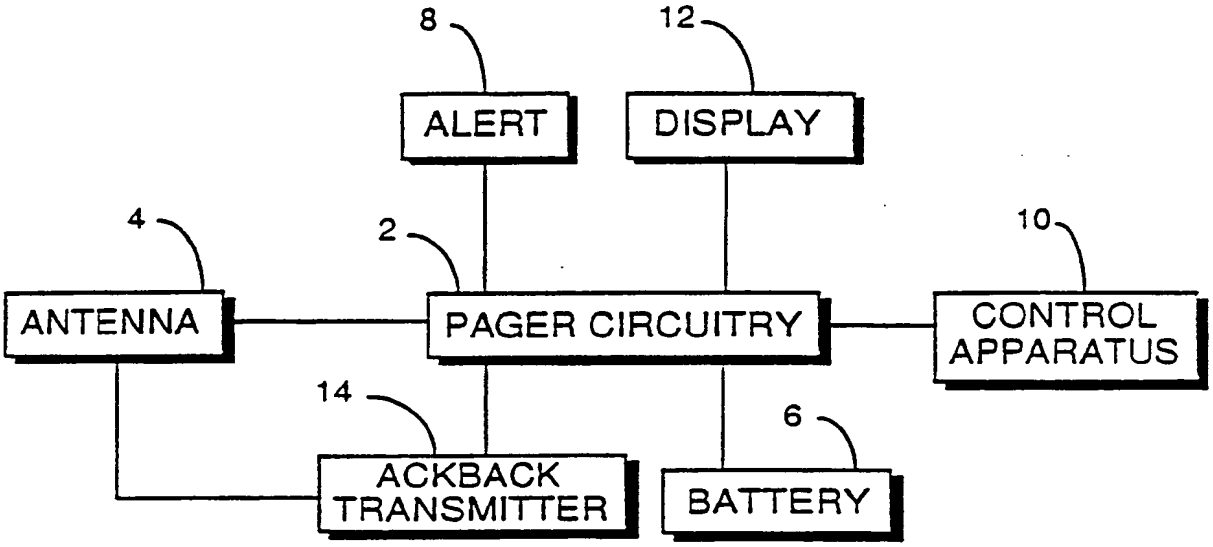
8
12
ALERT
DISPLAY
4
2
10
ANTENNA
PAGER CIRCUITRY
CONTROL APPARATUS
14
6
ACKBACK TRANSMITTER
BATTERY

FIG. 1

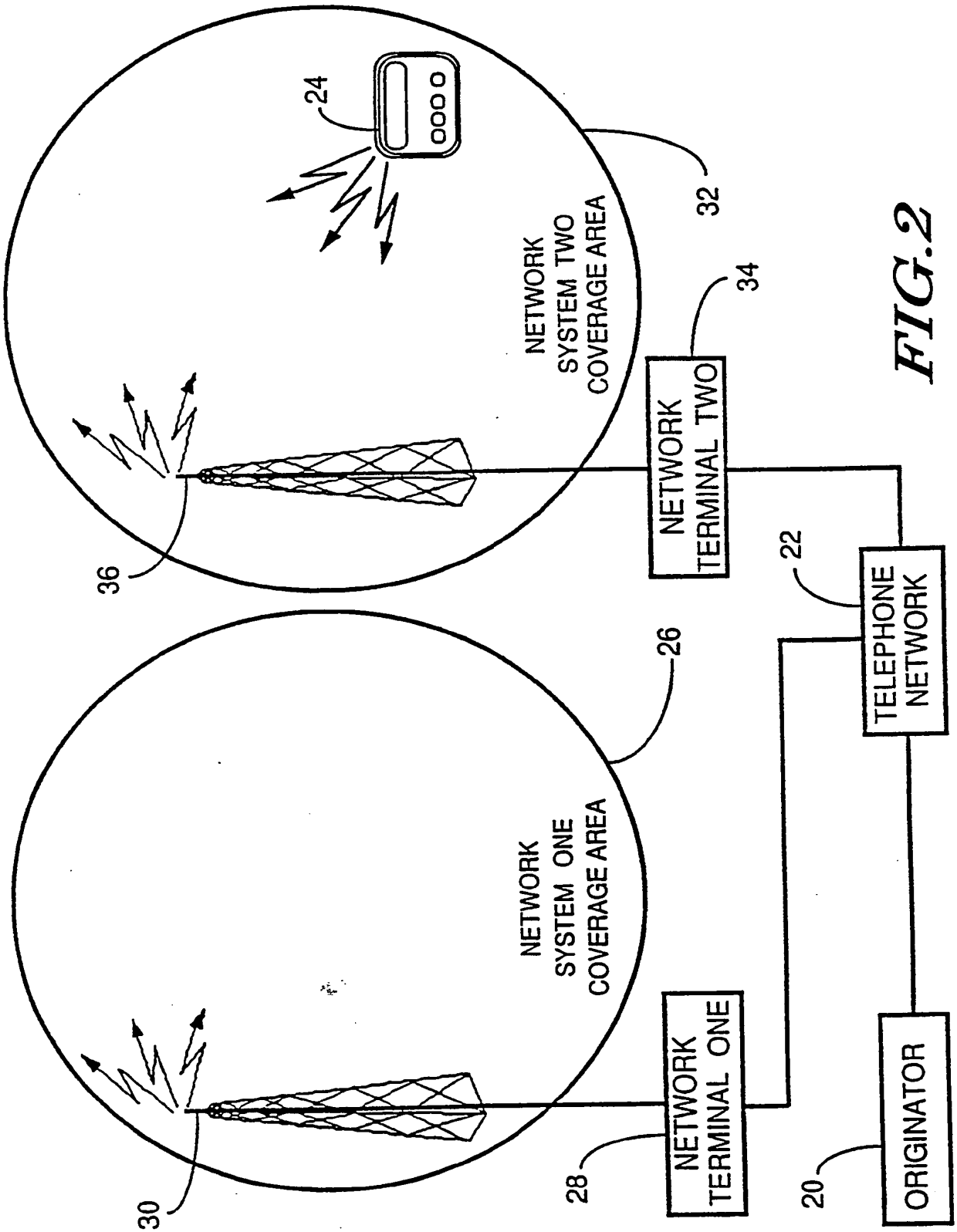
24
32
NETWORK SYSTEM TWO COVERAGE AREA
34
NETWORK TERMINAL TWO
36
22
TELEPHONE NETWORK
26
NETWORK SYSTEM ONE COVERAGE AREA
28
NETWORK TERMINAL ONE
30
20
ORIGINATOR

FIG.2

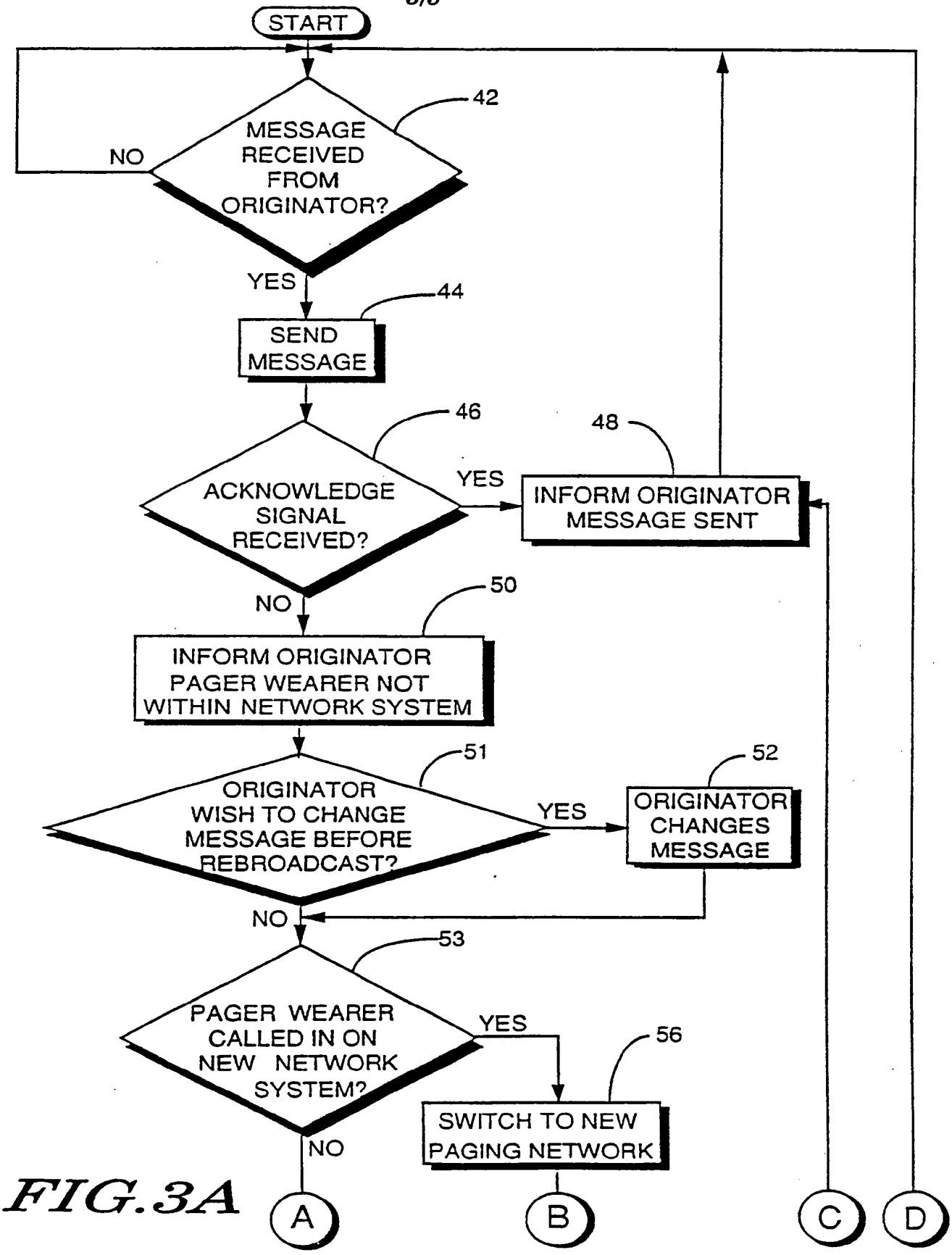
START
MESSAGE RECEIVED FROM ORIGINATOR?
42
NO
YES
SEND MESSAGE
44
ACKNOWLEDGE SIGNAL RECEIVED?
46
YES
INFORM ORIGINATOR MESSAGE SENT
48
NO
INFORM ORIGINATOR PAGER WEARER NOT WITHIN NETWORK SYSTEM
50
ORIGINATOR WISH TO CHANGE MESSAGE BEFORE REBROADCAST?
51
YES
ORIGINATOR CHANGES MESSAGE
52
NO
PAGER WEARER CALLED IN ON NEW NETWORK SYSTEM?
53
YES
SWITCH TO NEW PAGING NETWORK
56
NO
A
B
C
D

FIG. 3A

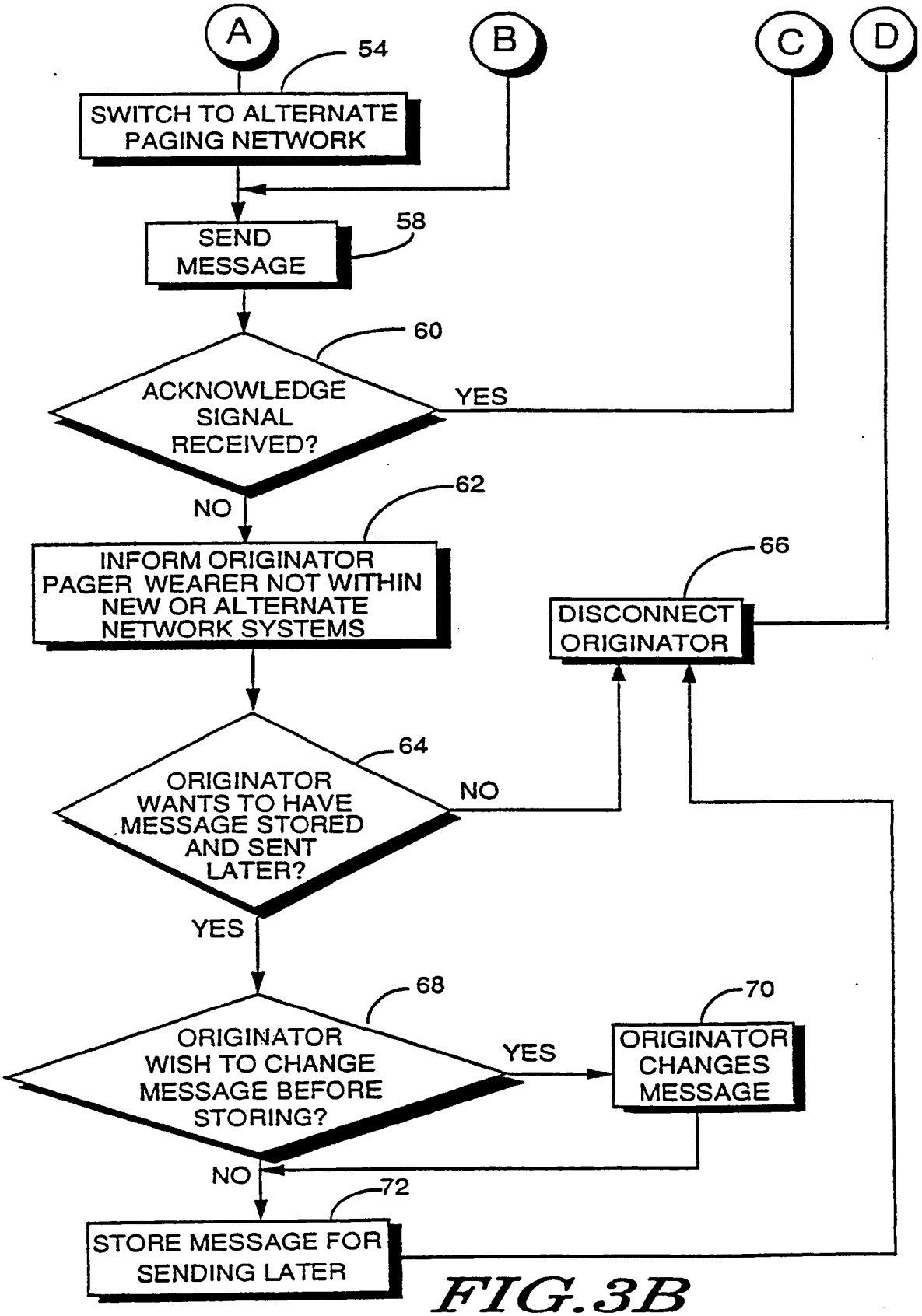
A
B
C
D
54
SWITCH TO ALTERNATE PAGING NETWORK
58
SEND MESSAGE
60
ACKNOWLEDGE SIGNAL RECEIVED?
YES
NO
62
INFORM ORIGINATOR PAGER WEARER NOT WITHIN NEW OR ALTERNATE NETWORK SYSTEMS
66
DISCONNECT ORIGINATOR
64
ORIGINATOR WANTS TO HAVE MESSAGE STORED AND SENT LATER?
NO
YES
68
ORIGINATOR WISH TO CHANGE MESSAGE BEFORE STORING?
YES
70
ORIGINATOR CHANGES MESSAGE
NO
72
STORE MESSAGE FOR SENDING LATER

FIG.3B

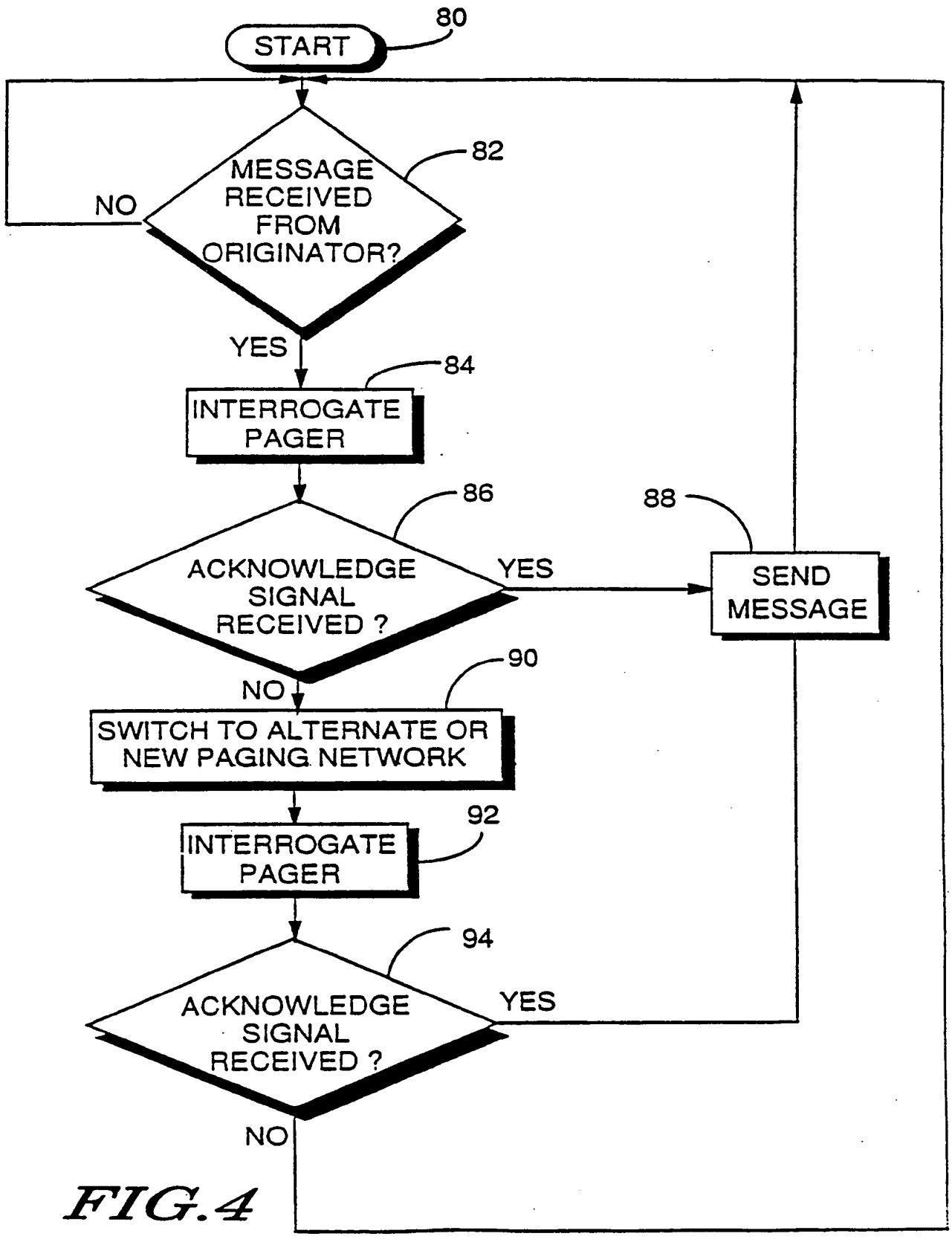
START
80
MESSAGE RECEIVED FROM ORIGINATOR?
82
NO
YES
INTERROGATE PAGER
84
ACKNOWLEDGE SIGNAL RECEIVED ?
86
YES
88
SEND MESSAGE
NO
SWITCH TO ALTERNATE OR NEW PAGING NETWORK
90
INTERROGATE PAGER
92
ACKNOWLEDGE SIGNAL RECEIVED ?
94
YES
NO

FIG.4

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US90/03734

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC (5) : H04Q 7/00
U.S. Cl : 340/825.44

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S.	340/825.44,825.49,311.1; 379/59,60; 455/32,33

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	US,A 4,843,622 (YOTSUTANI ET AL) 27 June 1989 See the entire document; particularly column 4, line 49 to column 5, line 32; column 7, lines 48-54; column 8, lines 32-70; and column 11, lines 34-43.	1-12
Y,P	US,A 4,876,738 (SELBY) 24 October 1989 See column 1, lines 35-38.	1-12
A	US,A 4,661,972 (KAI) 28 April 1987 See the entire document.	1-12
A	US,A 4,700,374 (BINI) 13 October 1987 See the entire document.	1-12

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
21 AUGUST 1990	14 DEC 1990

International Searching Authority	Signature of Authorized Officer
ISA/US	PETER WEISSMAN NGUYEN NGOC-HO INTERNATIONAL DIVISION

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